

Remarks

A. Pending Claims

Claims 1691-1743 are pending.

B. The Claims Are Not Obvious Over Eastlund et al. In View of Rose Pursuant To 35 U.S.C. §103(a)

Claims 1691-1743 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 4,716,960 to Eastlund et al. (hereinafter "Eastlund") in view of European Patent Application 0130671 to Rose (hereinafter "Rose"). Applicant respectfully disagrees with these rejections.

To reject a claim as obvious, the Examiner has the burden of establishing a *prima facie* case of obviousness. *In re Warner et al.*, 379 F.2d 1011, 154 U.S.P.Q. 173, 177-178 (C.C.P.A. 1967). To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974), MPEP § 2143.03.

Claim 1691 describes a combination of features including:

one or more electrical conductors located in the heater well, at least one of the electrical conductors extending from the surface into the hydrocarbon containing layer, and at least one of the electrical conductors being electrically coupled to the AC supply;

at least one electrical conductor comprising an electrically resistive ferromagnetic material, the electrical conductor being configured to provide an electrically resistive heat output during application of AC to the electrical conductor, and the electrical conductor being configured to provide a reduced amount of heat above or near a selected temperature, the selected temperature being within about 50 °C of the Curie temperature of the ferromagnetic material; and

wherein the system is configured to provide heat to the hydrocarbon containing formation such that sufficient heat transfers from at least one of the

electrical conductors to hydrocarbons in the hydrocarbon containing formation to at least mobilize some hydrocarbons in the formation.

Claim 1710 describes a combination of features including:

one or more electrical conductors located in the heater well, at least one of the electrical conductors extending from the surface into the hydrocarbon containing layer, and at least one of the electrical conductors being electrically coupled to the AC supply;

at least one electrical conductor comprising an electrically resistive ferromagnetic material, the electrical conductor being configured to provide an electrically resistive heat output during application of AC to the electrical conductor, and the electrical conductor being configured to provide a reduced amount of heat above or near a selected temperature that is about 20% or less of the heat output at about 50 °C below the selected temperature, and wherein the selected temperature is at or about the Curie temperature of the ferromagnetic material; and

wherein the system is configured to provide heat to the hydrocarbon containing formation such that sufficient heat transfers from at least one of the electrical conductors to hydrocarbons in the hydrocarbon containing formation to at least mobilize some hydrocarbons in the formation.

Claim 1729 describes a combination of features including:

providing AC at a frequency between about 100 Hz and about 1000 Hz to one or more electrical conductors located in a heater well extending from a surface of the earth into a hydrocarbon containing layer in the formation, wherein providing the AC produces an electrically resistive heat output from the electrical conductors, at least one of the electrical conductors comprising one or more electrically resistive ferromagnetic sections, ...

allowing heat to transfer from the electrical conductors to hydrocarbons in the hydrocarbon containing layer to at least mobilize some hydrocarbons in the layer.

The cited art does not appear to teach or suggest the combination of features set forth in the system claims including, but not limited to:

“one or more electrical conductors located in the heater well, at least one of the electrical conductors extending from the surface into the hydrocarbon containing layer, and at least one of the electrical conductors being electrically coupled to the AC supply;” and

“wherein the system is configured to provide heat to the hydrocarbon containing formation such that sufficient heat transfers from at least one of the

electrical conductors to hydrocarbons in the hydrocarbon containing formation to at least mobilize some hydrocarbons in the formation.”

The cited art does not appear to teach or suggest the combination of features set forth in the method claims including, but not limited to:

“providing AC at a frequency between about 100 Hz and about 1000 Hz to one or more electrical conductors located in a heater well extending from a surface of the earth into a hydrocarbon containing layer in the formation, wherein providing the AC produces an electrically resistive heat output from the electrical conductors, at least one of the electrical conductors comprising one or more electrically resistive ferromagnetic sections;” and

“allowing heat to transfer from the electrical conductors to hydrocarbons in the hydrocarbon containing layer to at least mobilize some hydrocarbons in the layer.”

Eastlund does not teach any of the above-mentioned combinations of features.

Significantly, Eastlund teaches away from the combination of features in Applicant’s claims. While Eastlund does refer to heaters below the ground in petroleum producing wells, these heaters are not used to transfer heat into any portion of any hydrocarbon containing layer and no reference is made to the heaters extending into any hydrocarbon containing layer. Rather, the heaters of Eastlund are used to prevent solids formation in the wellbores during petroleum production. Eastlund states: “This invention relates to a method and system for introducing electric power into a petroleum well. **Power may be used to heat the tubing or drive a load such as a pump.**” (Eastlund, column 1, lines 5-8) (emphasis added). Eastlund further states: “An object of this invention is to electrically heat the tubing of a petroleum well by passing current through the tubing **to prevent formation of solids such as paraffins.**” (Eastlund, column 1, lines 47-50) (emphasis added).

Furthermore, Eastlund teaches **low degrees of heating** that are not sufficient to mobilize any hydrocarbons in any hydrocarbon containing layer. Eastlund states: “Thus, at 200 feet, application of 5000 watts for 10.8 hours resulted in **an increase from 73 degrees to 85 degrees Fahrenheit.**” (Eastlund, column 4, lines 38-40) (emphasis added). The temperature increases shown in the table (column 4, lines 41-53) are no greater than 14 °F. These measured temperature increases were in the production wellbore itself. Any temperature increase within

the formation (or any hydrocarbon containing layer in the formation) by such a heater would be **less than** the temperature increase in the wellbore. Thus, Eastlund teaches **low degrees of heating** using the disclosed heater that would not provide sufficient heat to mobilize any hydrocarbons in any hydrocarbon containing layer.

In addition, the heaters of Eastlund appear to be above any hydrocarbon layer. For example, Eastlund states: “**At the lower end of the casing perforations 12** admit fluid from the formation into the well bore.” (Eastlund, column 3, lines 17-19) (emphasis added).

Applicant’s claims 1691 and 1710, however, refer to the combination of features including, but not limited to, “one or more electrical conductors located in the heater well, at least one of the electrical conductors extending from the surface **into the hydrocarbon containing layer**” and “sufficient **heat transfers from at least one of the electrical conductor to hydrocarbons in the hydrocarbon containing layer** to at least mobilize some hydrocarbons in the layer” (emphasis added). Applicant’s claim 1729 refers to the combination of features including, but not limited to, “providing an AC at a voltage above about 200 volts to one or more electrical conductors located in a heater well extending from a surface of the earth **into a hydrocarbon containing layer in the formation**” and “**allowing heat to transfer from the electrical conductors to hydrocarbons in the hydrocarbon containing layer** to at least mobilize some hydrocarbons in the layer” (emphasis added).

Rose relates to autoregulation in a “relatively small device.” See page 8, line 20. There is no teaching or suggestion in Rose of any of the above-mentioned combinations of features. Rose does not, for example, even mention wells or hydrocarbons. Rose does not, for instance, have any teaching relating to “electrical conductors in a heater well and extending from the surface into the hydrocarbon containing layer,” “voltage above about 200 volts,” and/or transferring heat from “electrical conductors to hydrocarbons in the hydrocarbon layer to at least mobilize some hydrocarbons in the layer,” in combination with the other features in Applicant’s claims.

In fact, Rose teaches away from the combinations of features in Applicant’s claims because Rose refers to heating fluids **inside** of the device. Specifically, Rose states: “It should be noted that the insulating layer 29 of Fig. 3 has been eliminated to provide a gap between

return conductor 27 and ferromagnetic layer 31. This gap insulates such members from one another and may be employed to heat fluids; air, gas, water, or other liquid, for a variety of purposes. Any one of the insulating layers may be removed to accept fluid and in fact, three different fluids may be heated simultaneously to three different temperatures.” (Rose, page 17, lines 18-26). Applicant’s claims 1691 and 1710, however, refer to the combination of features including, but not limited to, “one or more electrical conductors located in the heater well, at least one of the electrical conductors extending from the surface **into the hydrocarbon containing layer**” and “sufficient **heat transfers from at least one of the electrical conductor to hydrocarbons in the hydrocarbon containing layer** to at least mobilize some hydrocarbons in the layer” (emphasis added). Applicant’s claim 1729 refers to the combination of features including, but not limited to, “providing an AC at a voltage above about 200 volts to one or more electrical conductors located in a heater well extending from a surface of the earth **into a hydrocarbon containing layer in the formation**” and “**allowing heat to transfer from the electrical conductors to hydrocarbons in the hydrocarbon containing layer** to at least mobilize some hydrocarbons in the layer” (emphasis added).

Applicant submits that the combination of cited art does not appear to teach or suggest all of the features of claims 1691, 1710, 1729, and the claims dependent thereon.

Applicant submits, in addition, that some of the claims dependent on claims 1691, 1710, and 1729 are separately patentable.

Claims 1692 and 1711 describe combinations of features including: “at least one production well extending into the hydrocarbon containing layer and configured to produce at least some of the mobilized hydrocarbons from the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1692 and 1711, in combination with the other features of the claims.

Claims 1693 and 1712 describe combinations of features including: “wherein at least one electrical conductor transfers heat during use to hydrocarbons in the hydrocarbon containing layer to at least mobilize some hydrocarbons in the layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1693 and 1712, in combination with the

other features of the claims.

Claims 1694 and 1713 describe combinations of features including: “wherein at least one electrical conductor transfers heat during use to hydrocarbons in the hydrocarbon containing layer to pyrolyze at least some hydrocarbons in the layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1694 and 1713, in combination with the other features of the claims.

Claims 1695 and 1714 describe combinations of features including: “wherein the heater well extends from the surface of the earth through an overburden of the formation into the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1695 and 1714, in combination with the other features of the claims.

Claims 1696 and 1715 describe combinations of features including: “wherein at least one of the ferromagnetic sections heats during use to a temperature of at least about 650 °C.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1696 and 1715, in combination with the other features of the claims.

Claims 1697 and 1716 describe combinations of features including: “wherein the AC supply is coupled to a supply of line current, and wherein the AC supply is configured to provide AC at about three times the frequency of the line current.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1697 and 1716, in combination with the other features of the claims.

Claims 1698 and 1717 describe combinations of features including: “wherein the AC supply is configured to provide AC with a frequency between about 140 Hz and about 200 Hz.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1698 and 1717, in combination with the other features of the claims.

Claims 1699 and 1718 describe combinations of features including: “wherein AC supply is configured to provide AC with a frequency between about 400 Hz and about 550 Hz.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1699 and 1718, in combination with the other features of the claims.

Claims 1700 and 1719 describe combinations of features including: “wherein the ferromagnetic material comprises iron, nickel, chromium, cobalt, tungsten, or a mixture thereof.”

The cited art does not appear to teach or suggest at least the above-quoted features of claims 1700 and 1719, in combination with the other features of the claims.

Claims 1701 and 1720 describe combinations of features including: “wherein a thickness of the ferromagnetic material is at least about $\frac{3}{4}$ of a skin depth of the AC at the Curie temperature of the ferromagnetic material.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1701 and 1720, in combination with the other features of the claims.

Claims 1702 and 1721 describe combinations of features including: “wherein the heat output below the selected temperature is greater than about 400 watts per meter of the electrical conductor.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1702 and 1721, in combination with the other features of the claims.

Claims 1703 and 1722 describe combinations of features including: “wherein at least a portion of at least one of the electrical conductors is longer than about 10 m.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1703 and 1722, in combination with the other features of the claims.

Claims 1704 and 1723 describe combinations of features including: “wherein the system is configured to sharply reduce the heat output at or near the selected temperature.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1704 and 1723, in combination with the other features of the claims.

Claims 1705 and 1724 describe combinations of features including: “wherein the system is configured such that the heat output of at least a portion of the system decreases at or near the selected temperature due to the Curie effect.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1705 and 1724, in combination with the other features of the claims.

Claims 1706 and 1725 describe combinations of features including: “wherein the system is configured to apply AC of at least about 70 amps to at least one of the electrically resistive sections.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1706 and 1725, in combination with the other features of the claims.

Claims 1707 and 1726 describe combinations of features including: “wherein at least one of the electrical conductors comprises a turndown ratio of at least about 2 to 1.” The cited art

does not appear to teach or suggest at least the above-quoted features of claims 1707 and 1726, in combination with the other features of the claims.

Claims 1708 and 1727 describe combinations of features including: “wherein the system is configured to withstand operating temperatures of about 250 °C or above.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1708 and 1727, in combination with the other features of the claims.

Claims 1709 and 1728 describe combinations of features including: “wherein the electrical conductor is configured to automatically provide the reduced amount of heat above or near the selected temperature.” The cited art does not appear to teach or suggest at least the above-quoted features of claims 1709 and 1728, in combination with the other features of the claims.

Claim 1730 describes a combination of features including: “producing at least some of the mobilized hydrocarbons from the layer through a production well extending into the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1730, in combination with the other features of the claim.

Claim 1731 describes a combination of features including: “wherein the transferred heat pyrolyzes at least some hydrocarbons in the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1731, in combination with the other features of the claim.

Claim 1732 describes a combination of features including: “producing at least some of the pyrolyzed hydrocarbons from the layer through a production well extending into the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1732, in combination with the other features of the claim.

Claim 1733 describes a combination of features including: “wherein the heater well extends from the surface of the earth through an overburden of the formation into the hydrocarbon containing layer.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1733, in combination with the other features of the claim.

Claim 1734 describes a combination of features including: “wherein at least one of the ferromagnetic sections heats to a temperature of at least about 650 °C.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1734, in combination with

the other features of the claim.

Claim 1735 describes a combination of features including: “providing an initial electrically resistive heat output when the electrical conductor providing the heat output is at least about 50 °C below the selected temperature, and automatically providing the reduced amount of heat above or near the selected temperature.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1735, in combination with the other features of the claim.

Claim 1736 describes a combination of features including: “providing the AC at about three times the frequency of line current from an AC supply.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1736, in combination with the other features of the claim.

Claim 1737 describes a combination of features including: “providing the AC at a frequency between about 140 Hz and about 200 Hz.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1737, in combination with the other features of the claim.

Claim 1738 describes a combination of features including: “providing the AC at a frequency between about 400 Hz and about 550 Hz.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1738, in combination with the other features of the claim.

Claim 1739 describes a combination of features including: “wherein a thickness of at least one of the ferromagnetic sections is at least about $\frac{3}{4}$ of a skin depth of the AC at the Curie temperature of the ferromagnetic material.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1739, in combination with the other features of the claim.

Claim 1740 describes a combination of features including: “providing a reduced amount of heat above or near the selected temperature of less than about 400 watts per meter of length of the electrical conductor.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1740, in combination with the other features of the claim.

Claim 1741 describes a combination of features including: “controlling a skin depth in the electrical conductor by controlling a frequency of the AC applied to the electrical conductor.”

The cited art does not appear to teach or suggest at least the above-quoted features of claim 1741, in combination with the other features of the claim.

Claim 1742 describes a combination of features including: “controlling the amount of current applied to the electrical conductors to control an amount of heat provided by at least one of the electrically resistive sections.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1742, in combination with the other features of the claim.

Claim 1743 describes a combination of features including: “applying current of at least about 70 amps to the electrical conductor.” The cited art does not appear to teach or suggest at least the above-quoted features of claim 1743, in combination with the other features of the claim.

C. Provisional Double Patenting Rejections

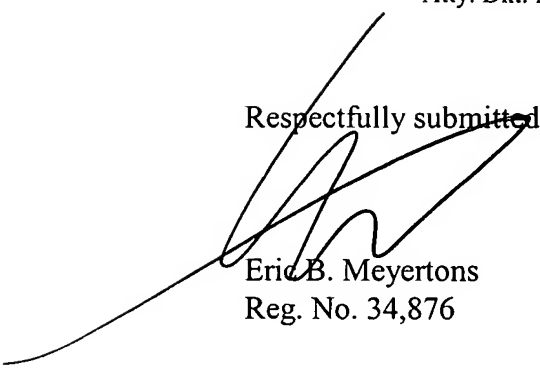
Claims 1691-1743 were provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1691-1747 of copending U.S. Pat. Appl. No. 10/693,820 and claims 1691-1753 of copending U.S. Pat. Appl. No. 10/693,840. Upon the present application being in condition for allowance but for the double patenting rejections, Applicant will provide arguments for the inappropriateness of the double patenting rejections and/or provide a terminal disclaimer.

D. Additional Comments

Applicant respectfully requests a one-month extension of time. If any additional extension of time is necessary, Applicant hereby requests the appropriate extension of time. A Fee Authorization is enclosed for the extension of time fee. If any additional fees are required or if any fees have been overpaid, please appropriately charge or credit those fees to Meyertons, Hood, Kivlin, Kowert & Goetzel, P.C. Deposit Account Number 50-1505/5659-21000/EBM.

Inventors: Sandberg et al.
Appl. Ser. No.: 10/693,700
Atty. Dkt. No.: 5659-21000

Respectfully submitted,



Eric B. Meyertons
Reg. No. 34,876

Attorney for Applicant

MEYERTONS, HOOD, KIVLIN, KOWERT & GOETZEL, P.C.

P.O. Box 398

Austin, TX 78767-0398

(512) 853-8800 (voice)

(512) 853-8801 (facsimile)

Date: 5/9/07